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FUNCTIONAL PROBLEMS OF THE VISUALLY IMPAIRED: A RESEARCH APPROACH

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ABSTRACT

Capabilities and limitations of severely visually impaired persons were assessed to learn how they are organized and influenced. Data representing a range of visual environmental adaptation problems were collected from a sample of 251 applicants to a comprehensive low vision clinic. Factorial analyses indicated that problems can be grouped on the basis of eight functional domains, among which an independent living skills factor accounted for most response variance. Major influences on outcomes in these domains are acuity, sex, age, education, and perceived impact of impairment on quality of life. Results suggested the usefulness of rehabilitation programs geared to activity domains rather than to vision parameters.

FUNCTIONAL PROBLEMS OF THE VISUALLY IMPAIRED: A RESEARCH APPROACH

The investigation described here represents an attempt to organize and understand functional problems of partially sighted persons. Recent research literature (e.g., Goldish and Marx, 1973; Sprague, 1977; Genensky, 1978) establishes that about 75 percent of the estimated half million legally blind individuals in the United States have usable residual vision. Another subset of the general population is severely visually impaired but not legally blind; that is, the best corrected vision (with conventional lenses) is still not adequate for accomplishing ordinary visually directed tasks such as reading newsprint. While estimates of the size of the latter group vary greatly depending on the criterion chosen to define "severe" impairment (cf. Genensky, 1978 and Sprague, 1977), it is agreed that these individuals confront many of the functional difficulties experienced by the legally blind. Using the most conservative estimates (Genensky, 1978), it can be inferred that the total population of partially sighted (the severely visually impaired, together with the legally blind who have remaining eyesight) currently number about two million.

Despite the size of this group, very little research has been directed toward exploring the capabilities and limits of residual vision for carrying out the activities of adult life. This conclusion is based on an automated search of five different bibliographic data bases (MEDLARS On-line, including BACKFILE and SDI Line; Smithsonian Science Information Exchange; Vision Index; National Technical Information Service; and ERIC Clearinghouse on Education). While a great deal of information is available about ocular diseases and about incidence of visual impairment, documentation of their effects on performance is virtually nonexistent. Thus Fozard et al. (1977), Baraga (1976), and other state-of-the-art reviews cite a pressing need for research related to visual functioning.

For example, Baraga (1976) urges studies explaining the way low vision functions in movement and travel and, more generally, in meeting routine daily living needs. Lee (1977), on the basis of his own recent

research, recommends investigation of the extent to which varying levels of illumination and contrast pose practical problems for the partially sighted. From somewhat different perspectives, Faye et al. (1976) and Fonda (1970) underscore the need to understand how recency of the experience of impairment affects functioning across a range of activities and situations, while Welsh (1978) suggests that reduced expectations following visual loss may further constrain performance.

It seems evident that, regardless of the specific domain of interest, little is known about the relationship between residual vision and performance. The research reported here aims at alleviating that gap by providing an empirical basis for grouping the most frequent functional problems of partially sighted persons into domains and by exploring variables that might account for differential competency within each domain.

These efforts rely heavily on a previous investigation of visual-environmental adaptation problems of partially sighted persons conducted by Genensky, Berry, Bikson and Bikson (1979). In that study 100 partially sighted subjects approximately balanced for sex and fairly evenly distributed over the adult age range (mean age = 47) were interviewed, examined by optometrists, observed in a variety of common orientation and mobility tasks, and administered a detailed survey tapping frequency and severity of difficulties in routine life activities. Results of the study indicated that subjects did not consider themselves "blind" and made efforts to lead independent adult lives. Further, while any activity could potentially constitute a visual-environmental adaptation problem, certain kinds of activities consistently posed functional difficulties. Finally, although subjects typically employed several visual aids and had received vision-related services, these interventions were not adequately organized to assist them in coping with functional problems. These results helped provide the foundation for a comprehensive low vision center oriented toward enhancing the usefulness of residual visual capability for carrying out an independent and satisfying life. The present study is a product of that center's research program.*

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METHOD

Subjects. Subjects were 251 visually handicapped persons, all applicants for treatment at the comprehensive low vision center. Patients selected for inclusion were of senior high school age or older and all were severely impaired. The sample was approximately balanced for sex (124 males, 127 females). Consent to participate was solicited at the beginning of the first center appointment.

Procedures. Data were collected in the course of the center's regular intake procedures. Dependent variables representing functional difficulties were measured by a 30-item question set devised on the basis of the visual-environmental adaptation research described above. For the present purpose, interview items were selected using three criteria: the designated activity is likely to be performed frequently by most partially sighted adults of both sexes; it represents a norm (rather than ceiling or floor levels) of independent functioning; and, insofar as possible, it is a paradigm instance of a class of similar activities. For questions which met these criteria, subjects were told:

> Right now I am going to read to you a list of activities that you may have difficulty doing by yourself because of your visual impairment. Please tell me whether you have difficulties with each activity.... Remember, we are concerned only with those activities that because of your visual impairment you either do with difficulty or don't do at all without someone else's help.

Responses on a three-point difficulty scale (see Table 1 below) provided dependent measures for analysis. Independent measures of visual, demographic, and psychosocial variables were drawn from other interview and examination records.

Analysis. The data so obtained were subjected to three sorts of analyses. First, factorial analyses were undertaken to see whether functional problems of visually impaired persons would exhibit an underlying structure that was coherent and interpretable. If so, resultant factor scores could be generated to provide a small number of dependent measures of functional domain difficulty. Such scores would then be treated in analyses of variance to determine whether visual, demographic and psychosocial sources of effect significantly influence performance.

Table 1

FUNCTIONAL PROBLEMS: ITEMS AND FACTOR LOADINGS

Visual Environmental Adaptation Items*	Functional Problem Factors	Loadings**	Item Responses (percentages) No Problem	Visual Problem	Does not do
Grooming		.65	45	52	4
Distinguishing denominations of money		.67	51	46	4
Distinguishing traffic signals		.62	38	58	4
Seeing oncoming traffic	1	.54	53	43	4
Using a telephone	(Independent Living Skills)	.60	58	39	3
Reading headlines, Large/Standard print		.40	26	68	6
Writing checks or letters		.34	29	53	18
Watching TV		.45	31	65	4
Locating offices in unfamiliar buildings		.84	31	50	19
Locating restrooms in unfamiliar buildings	2	.82	39	45	16
Using elevators	(General Orientation)	.77	49	36	15
Shopping in general		.42	21	51	28
Going upstairs	3	.81	64	30	6
Going downstairs	(General Mobility)	.80	53	41	6
Walking about alone		.41	51	40	9
Going from bright to dim areas	4	.79	26	74	0
Going from dim to bright areas	(Illumination Problems)	.78	34	65	0
Glare or bright lights		.61	21	79	0
Seeing at night		.48	43	53	4
Finding the right bus stop	5	.92	19	19	62
Determining numbers of oncoming busses	(Bus Travel)	.92	9	29	62
Preparing foods	6	.69	27	41	32
Household chores--sweeping, vacuuming	(Household Tasks)	.71	44	25	32
Taking medication, using a thermometer		.55	32	42	26

Recognizing familiar faces	7	.74	7	88	5
Reading facial expressions	(Social Perception)	.49	36	60	4
Meeting new people/developing relationships		.40	51	40	8
Being a spectator at sporting events, movies		.73	11	36	53
Participation in physical activities	8 (Recreational	.59	22	13	65
Hobbies	Activities)	.57	20	26	54

*N = 251

**Order of items represents strength of loading within factors rather than interview order.

RESULTS I

Results of the first step in the examination of data are presented in Table 1, which orders visual environmental adaptation items by the factors on which they load and, within factors, by strength of loading; percentage of respondents in the three original response categories is represented in the right-hand columns. Eight factors with eigenvalues greater than or equal to one were initially extracted by an exploratory principal components procedure; subsequently an orthogonal (Varimax) rotation was employed to generate loadings for the (uncorrelated) set of factors obtained (Table 1, middle columns). Listed in descending order of percent of variation explained, the eight factors jointly account for 60 percent of the total variance.

Patterns of items generated by the factor analysis are of considerable interest from the standpoint of both research and intervention, because they are basically interpretable for functional domains. From the data in Table 1 it appears that the capabilities and limitations of partially sighted persons are better organized and understood in terms of areas of activity (e.g., locating rooms in unfamiliar buildings vs. doing household chores) than in terms of visually common characteristics of activities (e.g., near vision tasks vs. distant vision tasks). Nowhere is this more apparent than within the first factor, which includes a heterogeneity of tasks with varied visual properties; all, however, are routinely involved in the conduct of daily life.

Among them the "grooming" item (where interview probes included "combing your hair," "cutting nails," "applying makeup or shaving") loaded highest; reading and writing items loaded less strongly, although these were the presenting problems most often mentioned by subjects on applying for treatment.

The second and third factors have been interpreted for general orientation and mobility respectively, since the items in the former group emphasize locational ability and those in the latter group emphasize ability to move about. For example, a probe for the shopping question (factor two) is "locating items." Illumination problems encountered in everyday environments constitute the fourth factor, where changes in illumination level produce the highest factor loadings. It should be noted that, unlike the others, this factor is defined primarily by items that refer to visual properties of behavioral contexts rather than functional ones (e.g., "going from bright to dim areas"). Consequently, regardless of the level of difficulty represented by such situations subjects cannot choose to avoid them, as the zeros in the "does not do" column indicate.

Two highly loading items constitute the fifth factor termed here "bus travel." Public transportation is of considerable importance to partially sighted persons, the vast majority of whom do not drive. In the metropolitan Los Angeles area from which this sample was drawn, intraurban distances are so great as to render travel by taxi cost-prohibitive (as determined during pretesting), and there are no commuter trains or subway systems. Inquiries were thus limited to bus travel. While we believe transportation would figure importantly in the functional problems of most severely visually impaired persons, we cannot estimate the extent to which bus travel difficulties are representative of the larger class of public transportation problems. The sixth factor is designated "household tasks" because it comprises a variety of items all of which refer to activities carried out at home. Unlike the independent living skills items, these activities could in principle be delegated (and often are, even by fully sighted individuals) without entailing loss of independence. The last two factors represent activity domains associated with the quality of life. Factor seven is organized around social perception situations, including meeting new people,

recognizing familiar faces, and decoding facial expressions. Factor eight includes a range of leisure activities from those involving physical participation (e.g., jogging, dancing) to less active pursuits (e.g., crocheting, cardplaying) to attendance at spectator events (e.g., movies, sports).

In order to quantify domains of functional capability and limitation and identify characteristics that explain variation in functional status, eight factor scores and a summary score were created for each subject. Specifically, eight scoring coefficients were generated for each item, reflecting its contribution to each of eight factors: These coefficients were used to weight individual responses, and weighted responses were summed to represent an individual's functional status in the corresponding activity domain. Then the eight factor scores for each subject were summed to yield a general index of functional status across activity domains. The resulting nine variables were treated as dependent measures of functional status in the second set of analyses as described below.

RESULTS II

Three classes of independent variables were employed to investigate sources of variation in functional status. Among them, visual variables included acuity, pathology, and duration of impairment. Acuity was first measured as a continuous variable, the best corrected acuity in the better eye. From these measures, a three-level categorical variable was defined in the following way: "fully sighted," as better than 20/70; "partially sighted," as 20/70 to but not including 20/200; and "legally blind," as 20/200 to but not including functional blindness.* Categories

*These categories were defined for research purposes and are not identical to those in common clinical use since they do not take field restrictions into account. We have omitted field restrictiveness as a criterion because it is difficult to quantify precisely and systematically. It should be noted that the "fully sighted" subjects accepted for Center treatment were regarded as seriously impaired even though their vision did not meet the acuity criterion for partial sightedness; typically such individuals had bad and rapidly deteriorating eyesight. Examination protocols and more detailed definitions of acuity level are available in Genensky et al., 1980.

of visual pathology were chosen on the basis of their frequency of occurrence diagnostically as well as in research literature. The resulting six-level variable comprises cataracts, choroid and retinal diseases, diabetic retinopathy, macular diseases, glaucoma, and others (including, for example, corneal and scleral disorders, congenital and developmental disorders, optic neuropathy, acquired neurological diseases, and so on).* The third vision variable is duration of visual impairment, defined as the time since the subject first experienced serious eyesight problems; for analysis purposes it is treated as a three-level variable with the categories "short" (within the last year), "medium" (two to six years), and "long" (more than six years).

A set of demographic variables was hypothesized also to affect functional status. Sex, age, education, income, and living arrangement of subjects were examined for this purpose. The last source of effect investigated was psychosocial. Two items from the intake interview were used to represent subjects' assessments of the influence of visual impairment on instrumental and qualitative aspects of everyday life (to what extent does your vision problem "affect your ability to carry out routine daily tasks" and "affect your ability to lead a happy life," respectively). These questions, answered in terms of a five point scale, yielded data that were grouped to produce a three level variable ("interferes a great deal," "interferes somewhat," and "has little or no effect").** The three sorts of explanatory variables were employed as independent factors in a series of one-way analyses of variance that sought to explore their effects on the dependent measures of functional status described in the preceding section.

Among the vision variables, acuity was found to affect functional status most strongly in a number of domains. The results of these analyses are summarized in Table 2, which provides means, values of F, and associated probability levels for all dependent measures of functional status significantly influenced by acuity category. (In this and subsequent tables absolute values of means are relatively

*Pathology codes are presented in more detail along with additional subject data in Genensky et al., 1980.

**Verbatim interview protocols are available in Genensky et al., 1980.

Table 2

FACTOR SCORES* AS A
FUNCTION OF ACUITY CATEGORY

Factor	Fully Sighted	Partially Sighted	Legally Blind	F,**	p***
1 (independent living skills)	-.46	-.01	.29	9.70,	p<.001
2 (general orientation)	-.25	-.12	.30	6.55,	p<.01
3 (general mobility)	-.06	-.19	.25	5.02,	p<.01
7 (social perception)	-.25	-.10	.28	5.77,	p<.01
SUMMARY SCORE	52.0	53.7	58.5	12.08,	p<.001
N	51	112	87		

*Scores represent group means. For factors as well as for the summary variables, higher scores indicate greater difficulty.

**Degrees of freedom = 2,247.

***Values of F were regarded as statistically significant if the associated probability was less than or equal to .05; all such values are tabled.

uninformative because they are derived from standardized factor scoring coefficients; however, direction and magnitude of differences between group means are informative.) It is evident that major areas of functional capability are importantly affected by acuity, with the independent living skills and the summary variable showing greatest impact. In most instances the direction of effect was as predicted--although fully sighted individuals in this sample have some acuity deficits, they are far less restricted functionally than partially sighted subjects; the latter, in turn, are less limited than the legally blind. When between-group comparisons are made, all three subsets differ significantly with respect to scores on the first factor and on the summary variable. However, such comparisons yield no significant differences

between fully and partially sighted subjects in orientation, mobility, and social perception; however, the partially sighted and the legally blind differ significantly on all three measures.

Remaining vision variables, in contrast, explain very little variation in functional status. Visual pathology yielded a significant effect only on the measure of general mobility ($F=2.06$, $p<.05$) where individuals in the diabetic retinopathy, glaucoma, and "other" categories fared far worse than the rest. Duration of impairment was found to account for significant differences in scores on the bus travel ($F=3.45$, $p<.05$) and recreational activities ($F=3.16$, $p<.05$) factors. Interestingly, duration is positively related to functional capability, those with longer experience of impairment reporting fewer difficulties in these domains.

Demographic variables examined next accounted for substantial variation in functional status. Unexpectedly, sex was found to be the strongest explanatory variable in this set, influencing five of eight factor scores as well as the summary score. Results of analyses of variance with sex as the independent factor are summarized in Table 3. As these data make clear, in four of five specific functional domains (independent living skills, general orientation, general mobility, and bus travel), visually impaired women are substantially more restricted than their male peers. In only one domain (household tasks) is greater functional capability attributable to female subjects. The accumulation of nonsignificant differences in the same direction on remaining factors contributes to very strong sex differences on the summary variable. These outcomes can probably be understood in part of differing sex role socialization. That is, women in the age range predominantly represented in this sample may have been socialized to accept dependency and may not have acquired as great a range of independent functional skills and/or as strong a response bias toward asserting them as same-aged men. On the other hand, sex role socialization may pose barriers to the expression by visually impaired men of legitimate dependency needs.

Other demographic variables had far less influence. Specifically, age group was a less important determinant of functional capability than had been expected. For the purpose of these analyses, age was treated

Table 3

FACTOR SCORES* AS A
FUNCTION OF SEX OF SUBJECT

Factor	Males	Females	F**,	p***
1 (independent living skills)	-.24	.24	15.32,	p<.001
2 (general orientation)	-.16	.16	6.58,	p<.01
3 (general mobility)	-.13	.13	4.42,	p<.05
5 (bus travel)	-.18	.18	8.52,	p<.01
6 (household tasks)	.19	-.19	9.23,	p<.01
SUMMARY SCORE	53.0	57.2	14.87,	p<.001
N	124	127		

*Scores represent group means. For factors as well as for the summary variables, higher scores indicate greater difficulty.

**Degrees of freedom = 1,249.

***Values of F were regarded as statistically significant if the associated probability was less than or equal to .05; all such values are tabled.

as a four-level variable representing youth, working age adults, older adults, and the very old (15-20, 21-59, 60-74, 75-93, respectively). So defined, age group had a significant effect on the summary variable ($F=15.10$, $p<.001$) and on factor 8, recreational activities ($F=5.0$, $p<.01$). In relation to recreational participation, the four groups all differ from one another with younger subjects reporting less limitation as predicted. However, the summary variable mean scores for the old and very old are virtually equivalent and differ substantially from the relatively comparable means obtained for working age subjects and youth. Other dependent measures showed similar patterns although the differences were not statistically significant. For example,

independent living skills (factor 1) scores showed both young and working age adults to be relatively advantaged in comparison with the old and very old ($F=2.34$, $p=.07$).

Education was also treated as a categorical variable for these analyses, subjects being grouped on the basis of whether they had less than a high school diploma, had completed high school, or had some schooling beyond high school. Like age group, education level yielded significant differences on the summary measure ($F=3.22$, $p<.05$) and factor 8, the measure of recreational participation ($F=5.06$, $p<.01$); in addition it influenced factor 5, bus travel ($F=4.76$, $p<.01$). In every instance differences were attributable to the very sharp contrast between scores attained by those who had not completed high school and others, the former being seriously disadvantaged. Income, categorized as high (over $10,000 per year), medium ($5,000-$10,000) or low (below $5,000), was less pervasive in its effects but like education yielded systematic advantages for higher socioeconomic levels. In particular, significant effects were obtained for income on measures of recreational activities ($F=6.64$, $p<.01$) and general orientation ($F=3.44$, $p<.05$) with the lowest income group reporting most serious difficulties in these domains. Finally, general orientation (factor 2) scores were also affected by household situation ($F=4.07$, $p<.05$); interestingly, those who lived in larger households fared worse in this functional status domain than either those who lived alone or those who lived only with one other, a spouse. This result is perhaps explained by the greater availability of assistance from others in larger households, making acquisition of locational skills less necessary. Living arrangement had no other effects on the dependent measures studied.

The two psychosocial variables, perceived influence of visual impairment on instrumental and qualitative aspects of daily life, also served as independent factors in similar analyses of variance. Perceived influence of impairment on ability to carry out routine daily tasks accounted for very little variation in dependent measures of functional status. Only scores on the illumination factor (factor 4) showed significant effects ($F=3.14$, $p<.04$); observed differences were in the expected direction, those reporting that the impairment had little or no effect on routine task performance exhibiting least

difficulty in the illumination problems domain. In contrast, perceived impact of impairment on quality of life showed a substantial relationship to functional status in several domains. Results are summarized in Table 4, where scores on the summary variable as well as dependent measures of general orientation (factor 2), illumination problems (factor 4) and household tasks (factor 6) are significantly differentiated by this psychosocial variable. In every case differences are in the predicted direction, a pattern that is repeated among means on other dependent measures for which the differences were not statistically significant. Their systematic accumulation is, however, reflected in the very strong effect on the summary variable, indexing the very important relationship between subjective assessment of qualitative effects and functional capabilities and limitations of severely visually impaired subjects.

Table 4

FACTOR SCORES* AS A FUNCTION OF
PERCEIVED IMPACT OF VISUAL IMPAIRMENT ON QUALITY OF LIFE

Factor	Interferes a Great Deal	Interferes Somewhat	Has Little or No Effect	F**, p***
2 (general orientation)	.07	-.17	-.30	3.12, p<.05
4 (illumination problems)	.22	.14	-.22	3.99, p<.05
6 (household tasks)	.12	.03	-.27	2.97, p=.05
SUMMARY SCORE	58.2	55.6	51.5	10.14, p<.001
N	49	83	71	

*Scores represent group means. For factors as well as for the summary variables, higher scores indicate greater difficulty.

**Degrees of freedom = 2,200.

***Values of F were regarded as statistically significant if the associated probability was less than or equal to .05; all such values are tabled.

In order finally to examine these relationships at a multivariate level for purposes of comparing effects of predictor variables taken separately and in combination, a series of multiple regressions was carried out. Each of the nine functional status measures was regressed on the visual, demographic, and psychosocial variables employed as independent factors in the analyses just described. In the regression equations, however, the following changes were made: acuity, duration of impairment, and education (years of schooling) were taken as continuous variables; sex was treated as a dummy variable representing one of two categorical levels while income, living arrangement, perceived impact on routine task performance, and perceived impact on quality of life were treated as dummy variables representing two of three categorical levels; and the six-level pathology variable was omitted because it explained very little variation in dependent measures but would greatly expand the set of predictor variables.

The results so generated provided corroboration of results obtained from bivariate analyses on functional status. The predictor variables jointly explained from 8 percent to 29 percent of the variation in functional capabilities and limitations. Since these analyses provided little new information, only the results of regressing the summary measure on predictor variables are presented below (Table 5). As Table 5 indicates, the independent factors account for a significant proportion of the total variation in overall functional status ($p<.001$). In this analysis, acuity tends to be a significant predictor of general functional difficulty; however, as would be expected on the basis of analyses of variance, it figured more substantially ($p<.01$) in the explanation of difficulty in the general living skills domain. Among demographic variables, sex and education were observed to be strongest predictors of general functional status; as in the analyses of variance, being female was associated with greater limitation ($p<.01$) while better education was predictive of greater capability ($p<.01$). Finally, the subjective assessment of impact of visual impairment on quality of life was found to contribute most importantly to variation in overall functional status ($p<.001$).

Table 5

PREDICTION OF GENERAL FUNCTIONAL STATUS
(SUMMARY MEASURE) BY VISUAL, DEMOGRAPHIC AND PSYCHOSOCIAL VARIABLES

Predictors		t Values (df = 115)
visual	Acuity	1.78[t]
	Duration of visual impairment	-.60
demo-graphic	Sex (female)	2.33*
	Age	1.11
	Education	-1.97*
	Income	
	middle	.34
	upper	.23
psycho-social	Perceived impact on routine task performance	
	interferes somewhat	-.49
	little or no effect	-.54
	Perceived impact on quality of life	
	interferes somewhat	-.88
	little or no effect	-2.74**
Explained variance (multiple R^2) = .22, F = 2.25**, df = 13, 103		

[t] $p \approx .05$
* $p < .05$
** $p < .01$

CONCLUSIONS AND IMPLICATIONS

Two important and related conclusions emerge from this study: the first is that problems of partially sighted persons can be organized on the basis of functional domains, and the second is that status of individuals in these domains is explained not only by their visual characteristics but also by demographic and psychosocial variables. While the two theses are interdependent, they will for convenience be discussed separately here.

It was hypothesized that problems experienced most frequently by the severely visually impaired would group on the basis of common vision-related properties, e.g., near- or intermediate- or distant-viewing problems, field restriction problems, and so on. Instead it became apparent that problems fall into groups that can best be interpreted as representing functional domains such as independent living skills, general orientation, general mobility, and the like. This finding is of considerable importance for rehabilitation since it suggests that intervention efforts could suitably and productively be organized around types of activities (e.g., social interactions, household tasks) rather than around types of devices (e.g., canes, magnifiers).

Among the functional domains explored, capabilities within the first four (constituted by factors 1 through 4) seem most necessary to the maintenance of an independent noninstitutional life. While these factors were represented by 19 items most of which posed visual difficulties for a substantial proportion of the subjects, only reading and writing were frequently cited as presenting problems even though these two activities are neither rated as exceptionally severe nor exceptionally highly correlated with the first factor. In our view this incongruence suggests either that partially sighted persons are used to thinking of visual environmental adaptation problems in fairly narrow terms (e.g., as near-viewing difficulties) or that they are unaware of the possibilities for intervention directed toward other types of activities.

In fact, of all low vision aids in use by subjects at intake, 68 percent were conventional lenses or hand-held magnifiers--devices most appropriate for alleviating reading and writing problems. In contrast, a rehabilitation approach aimed more broadly at the domains described

here would do well to make use of the varied array of optical, electro-optical and nonoptical devices currently available for enhancing severely reduced vision. The illumination problem domain presents a fruitful area for more broadly conceived intervention in this regard. Items loading on that factor obtained the most frequent difficulty responses; averaging across items, 68 percent of subjects have visual problems with illumination. Such problems could be addressed through the prescription or recommendation of light control aids and training in their use (ranging from low cost devices such as visors, sunglasses and filters to highly sophisticated and expensive devices such as the infrared nightscope). It is also important to take note of the potential role of environmental interventions and other nonoptical methods for increasing functional capabilities, especially in relation to the first three functional domains. Examples in the latter category include large-print telephone dials or check-writing templates. In the former are included high-contrast stripes on the runners and risers of stairs, large-print and high-contrast designations on office doors, public restrooms, and the like.

The last four functional domains (factors 5-8) seem to represent activity areas vital to a full and rewarding lifestyle. While interview data indicated that subjects were dissatisfied with their current levels of social participation (see Genensky et al., 1980), the item set that generated the factor structure needs expansion so that these domains could be better defined and understood. For instance, we have noted the likelihood that bus travel too narrowly represents the public transportation difficulties of the severely visually impaired. Further, considerably more information is needed about the barriers to social interaction generated or aggravated by visual impairment. Given that the items underrepresent the extensiveness and complexity of activities in these domains, it is nevertheless clear that their alleviation requires a rehabilitation approach that deemphasizes devices and stresses educational and psychosocial intervention.

Investigating variables that might explain variation in functional capability and limitation led to the conclusion that for each domain, different independent measures significantly influence functional status.

Vision variables were important but not dominant in predicting outcomes, a result that should affect the way intervention efforts are undertaken. Among the vision variables studied, only acuity was of major significance. Its influence is most notable in the first three factors, where it is also evident from the analyses of variance that a tripartite division of visual impairment of the sort employed here is useful and warranted. That is, individuals called "partially sighted" as defined above differ substantially in functional terms from the visually impaired whose acuity is still within the range of correction by ordinary lenses; and those whose acuity is so impaired that their vision falls within the range of legal blindness are, in turn, significantly more limited than the partially sighted with more residual vision. Nonetheless all three groups should be differentiated from the functionally blind since all subjects performed most of the activities studied on a visually directed basis.

Demographic variables were found to be as important as visual variables in explaining functional capabilities and limitations. Among them, sex and education had greatest influence. Since gender per se could not readily be linked to performance level for most activities, it was assumed that sex role socialization differences accounted for the results. Further research is needed to determine the relative contributions to this effect of response bias and of skill repertoires, suggesting the desirability of collecting behavioral as well as self report measures. Such information would help determine ways in which sex role socialization bears on adaptation to sensory impairment. That outcomes are significantly influenced by education (and more strongly so than by income) is promising since it is susceptible to intervention. Moreover, analyses indicated that the most severe functional limitations are associated with failure to attain a high school education. Rehabilitation efforts, then, should stress educational continuation. Further, age was a less important predictor than expected. It is worth noting, however, that the largest functional status differences seem to occur between the working age and older (i.e., over 60) subjects, the latter perhaps requiring special rehabilitative efforts to avoid institutionalization.

Finally, while we expected psychosocial variables to yield some effects, we were surprised at their magnitude. Perceived influence of visual impairment on quality of life was the strongest single predictor of overall functional status. On the other hand, subjective assessment of degree of interference with routine task performance was a much weaker predictor. This contrast has two interesting implications. First, it suggests that the significant results are not simply artifactual (i.e., those who report specific activity problems are not necessarily those who report general interference of visual impairment in daily life). Second, it suggests that what depresses functional status is not so much an inability to accomplish things as the psychosocial costs of the effort. In any case, it is clear that further research is needed into the psychosocial concomitants of visual impairment. Moreover it also seems clear that rehabilitation should include a strong psychological component directed toward successful adaptation to reduced vision.

Currently the model for rehabilitation of the severely impaired who have usable residual vision is based largely on ophthalmologic and optometric interventions. Historically the partially sighted who were not legally blind, if they received any services, were treated by optometrists with little specialized low vision training; and the partially sighted who were legally blind typically received services designed for the functionally blind. In many cases such individuals were trained not to use residual vision but to substitute other procedures (e.g., braille, cane travel or guide dog use). Given the present array of optical and nonoptical devices for the severely impaired, there is a growing awareness that if a partially sighted person is not functionally blind, residual vision can be trained and enhanced so that these persons have a reasonable chance of being rehabilitated within the sighted society. The number of low vision clinics emerging nationwide is evidence for this trend.

However, the results of the analyses discussed above strongly suggest that interventions focused on visual characteristics are, while necessary, not sufficient for successful rehabilitation. Rather, demographic and psychosocial characteristics of the person must be

given equal emphasis in designing intervention approaches. Finally, such efforts need to be directed toward performance in areas of functional difficulty, so that multifaced rehabilitation programs can supply partially sighted clients with problem-solving strategies and guided practice that--when combined with appropriate visual and psychosocial interventions--will provide full participation in the activities that are important to an independent and satisfying life. Figure 1, below, suggests a paradigm for such an approach to comprehensive rehabilitation.

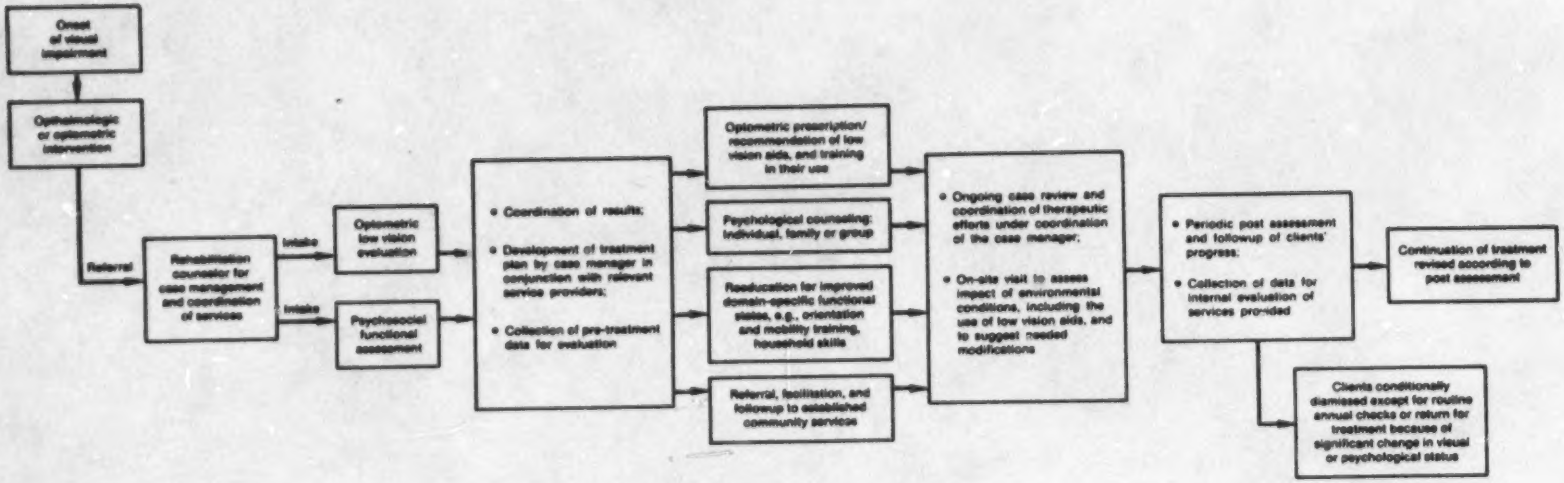
Onset of visual impairment
Ophthalmologic or optometric intervention
Referral
Rehabilitation counselor for case management and coordination of services
Intake
Intake
Optometric low vision evaluation
Psychosocial functional assessment
• Coordination of results;
• Development of treatment plan by case manager in conjunction with relevant service providers;
• Collection of pre-treatment data for evaluation
Optometric prescription/ recommendation of low vision aids, and training in their use
Psychological counseling: individual, family or group
Reeducation for improved domain-specific functional states, e.g., orientation and mobility training, household skills
Referral, facilitation, and followup to established community services
• Ongoing case review and coordination of therapeutic efforts under coordination of the case manager;
• On-site visit to assess impact of environmental conditions, including the use of low vision aids, and to suggest needed modifications
• Periodic post assessment and followup of clients' progress;
• Collection of data for internal evaluation of services provided
Continuation of treatment revised according to post assessment
Clients conditionally dismissed except for routine annual checks or return for treatment because of significant change in visual or psychological status

Fig. 1—Comprehensive intervention model

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